1   Abstract

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3   In a first aspect of the invention, different aspects of the packet header and

4   data included in the packet are singled out for attention, rather that just the four byte IP

5   destination address. This allows the M-trie Plus to perform functions that TRIES were

6   unable to do. The current TRIE distinguishes only between the leaf and node type ele-

7   ments and is used only for routing. The M-trie Plus extends this and includes different

8   information in the nodes of the trie which enables matching and branching on different

9   header fields. The basic building block of all M-trie Plus nodes is an oppointer. The op-

10   pointer includes an address and an opcode. In a preferred embodiment, the address in-

11   cluded in an oppointer is the address for the next node. The opcode included in an op-

12   pointer describes what action the router or switch has to do on the packet label to select

13   the next oppointer leaf on the M-trie Plus data structure. If an oppointer points to the 8

14   bit termination leaf, the lookup is terminated. High speed packet header processing is

15   achieved by the multiple pipelined threads of the M-trie Plus engine (MPE) and a wide

16   memory bus. In a second aspect of the invention, the ACL of a configuration file in a

17   router or switch is compiled into an ACL – M-trie Plus data structure which is located in

18   the memory of the router or switch. This has the effect of merging routing and ACL

19   processing in a single device. The M-trie Plus data structure 200 is traversed with respect

20   to information included in the packet header, thereby determining whether a packet

21   should be dropped or forwarded. ACL lists are defined in the configuration file of the

22   router or switch. In a preferred embodiment, there are two forms of access list in the IOS:

1   the standard ACL and the extended ACL. Standard lists are used to control traffic based

2   on one or more source IP addresses. The extended access list provides a finer granularity

3   in controlling traffic. ACL definitions provide a set of criteria that are applied to each

4   packet that is processed by the router or switch. The router or switch decides whether to

5   forward or drop each packet based on whether or not the packet matches the access list

6   criteria. Typical criteria defined in ACLs are source addresses, destination addresses or

7   upper-layer protocols of the packet. In a third aspect of the invention, the M-trie Plus

8   structure 200 can map a multicast packet header by a sequence of nodes that match on

9   destination address or source address. Each physical port uses the M-trie Plus with the

10   first level nodes matching on the first 8 bits of the destination address, the second level

11   nodes matching on the second 8 bits of the destination address and so on, at each level the

12   nodes correspond to multicast addresses. In a preferred embodiment, the opcode included

13   in a node can specify other operations, such an instructions to compare bytes in the packet

14   header with bytes in a CAM (contest addressable memory) or to direct certain types of

15   packets (for example, voice traffic) to a specified output interface.

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